

REMARKS

Amendments

Independent claims 1, 21, and 25 are amended to further define the support as being zirconia that is stabilized with yttrium. Support for this feature is found in the published specification in paragraphs [0031], [0035], [0041], [0045], [0051], [0058] and Table 1.

The added new claims 54 - 64 are directed to a novel catalyst composition. The composition of new independent claim 54 is a catalyst useful in the selective oxidation of sulfur that is contained in a hydrocarbon feedstock and comprises zirconia that is stabilized with yttria and also contains both cerium and rhodium. Support for these features is found in the published specification in paragraphs [0015], [0018], [0031], [0035], [0041], [0045], [0051], [0058] and Table 1. As indicated therein, this inventive composition provides for a better conversion activity, i.e., lower reaction temperature for a given H₂S conversion, than that of the comparative catalyst. See [0019], [0045], and Table 1.

In new independent claim 60 the composition is similar to the one of claim 54, but it further uses the transitional language of “consisting essentially of” and it requires the further presence of iridium. Support for these features are found in the specification as noted above. The specification describes in numerous locations the basic and novel characteristics of the inventive composition. As noted in the specification, the catalyst provides for a more active catalyst in that a lower temperature is required for a given conversion in the oxidation of H₂S than is required for the comparative catalyst. See [0019], [0045], and Table 1.

§103(a) Rejection of claims 1-2, 9, 11-19, 21 and 24 over Frame (US 3,978,137) in view of Yoo (US 3,945,914) and Mahadev (WO 92/20621).

The independent claims 1, 21, and 25 have been further amended to clearly define the carrier as comprising zirconia that has been stabilized or partially stabilized with yttria. The newly presented process claims 45-53, which depend from either independent claim 1, or 21, or 25, provide additional clarification of the catalyst of the independent claims by further limiting the catalyst composition to require zirconium and cerium components instead of making them optional components of the catalyst.

The remarks, arguments and distinctions that have been presented by the Applicants in the prior prosecution of this application are incorporated herein by reference and, therefore, they are not repeated.

The Examiner indicates that for the purposes of searching and applying the prior art, he is to treat the transitional phrase “consisting essentially of” as if it is equivalent to the term “comprising” in the absence of a clear indication of the basic and novel characteristics of the invention. The Applicants’ specification, though, does clearly present the basic and novel characteristics of the catalyst.

Presented in Example 1 are details concerning the catalyst of the invention and of a comparative catalyst. See paragraphs [0030] – [0045]. As described in Example 1, the inventive catalyst includes a support particle of zirconia that is partially stabilized with yttria (Y-PSZ). The support particles may be painted with a zirconia paint and impregnated with at least one or more of either rhodium, iridium, zirconium, or cerium. Presented in Table 1 is performance data for the inventive catalyst and for the comparison catalyst. The data show that the inventive catalyst provides for a higher H₂S conversion for a given reaction temperature than does the comparison catalyst, and the selectivity is significantly different as well. See paragraph [0045] and Table 1. The specification also suggests that the catalyst provides for a lower reaction temperature for carrying out the oxidation of sulfur compounds and that at these lower temperatures the oxidation of the sulfur compounds takes preference over the oxidation of hydrocarbons. See paragraph [0019].

As noted in the remarks above, the specification provides much discussion that indicates the basic and novel characteristics of the catalyst of the invention.

One distinction of the claimed process over the teachings of the Examiner’s cited references is that the yttria is used to stabilize or partially stabilize the zirconia of the catalyst carrier. There is no indication in the cited prior art of the use of yttria for the purpose of stabilizing zirconia that is used as a catalyst support.

With the requirement that the catalyst is to exclude those components that materially affect its basic and novel characteristics and with the prior art failing to teach all of the recited elements of the catalyst of the invention, it is respectfully submitted that these distinctions and many of those noted in the earlier prosecution of this application are sufficient to render the invention of claims 1-2, 9, 11-19, 21 and 24, and the newly presented process claims 45-53, unobvious and patentable over the prior art.

§103(a) Rejection of claims 1-2, 9, 11-21 and 24 over De Jong (US 5,720,901).

The process taught by De Jong relates to the catalytic partial oxidation of hydrocarbons to what is known in the art as synthesis gas, i.e., carbon monoxide and hydrogen. See column 1, lines 5-20. This is not the same as and is a significantly different process or reaction than the

Applicants', which relates to the catalytic selective oxidation of sulfur compounds contained in a hydrocarboneous feedstock. It is the goal of the Applicants' process to selectively oxidize the sulfur compounds to SO₂ without the oxidation of the hydrocarbons. But, on the other hand, the De Jong process involves the oxidation of hydrocarbons. These are completely different processes. De Jong indicates that a catalyst which may be used in its process comprises a catalytically active Group VIII metal. See column 5, line 65 – column 6, line 6. De Jong further states that the most suitable catalyst for its process comprises ruthenium, rhodium or iridium as the catalytically active metal. See column 6, lines 6-10. A suitable carrier material may include the refractory oxides, such as silica, alumina, titania and mixtures thereof. See column 6, lines 11-17. The active metal may be deposited on the carrier by known techniques in an amount in the range of from 0.01 to 20% by weight. See column 6, lines 18-30.

One major difference between the De Jong process and the Applicants' process is that the De Jong process involves the oxidation of hydrocarbons, but the Applicants' process, instead, involves the oxidation of sulfur compounds to sulfur dioxide. De Jong states that the catalyst compositions suitable for use in the catalytic partial oxidation of hydrocarbons are known in the art. See column 5, lines 65-66. The preferred catalysts for use in the De Jong process are described in general terms. De Jong does not mention the use of a yttria stabilized zirconia carrier with the particular combination of active metals of the Applicants' catalyst.

De Jong clearly fails to disclose and teach each and every feature of the Applicants' claimed invention, and the patent is even directed to a process that is completely different from the Applicants'. In view of this, claims 1-2, 9, 11-21 and 24 are plainly patentable over De Jong.

§103(a) Rejection of claims 25, 26, 30, and 33-44 over De Jong (US 5,720,901) in view of D'Souza (US 4,233,276).

In this rejection the Examiner uses the secondary D'Souza reference to try to supply features of the recited removing step of the Applicants' claimed process that are not taught by the primary De Jong reference. While it is questionable whether the two references are even combinable, assuming for the sake of argument that they may be combined and that the D'Souza patent discloses all of the features of the Applicants' claimed removing step, the combination still does not as noted above disclose and teach all the elements and features of the claimed invention. Thus, claims 25, 26, 30, and 33-44 are patentable over any combination of the De Jong and D'Souza references.

New Composition claims 50-64

The newly presented composition claims include the two independent claims 54 and 60. The novel catalyst composition requires its zirconia component to be stabilized or partially stabilized with yttria. The composition of claim 54 requires both cerium and rhodium to be incorporated into the particle. The composition of claim 60 requires rhodium, iridium, cerium and combinations thereof to be present but it excludes additional components that affect the basic and novel characteristics of the composition other than those recited in the claims that depend therefrom. The significance of these features as they relate to the patentability of these claims is discussed above.

Conclusions

In view of the above amendments and remarks, it is respectfully submitted that the claims now pending are patentable. Therefore, early allowance of the now pending claims is respectfully submitted.

Respectfully submitted,

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